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Technology Innovation Office

TECH TRENDS

The applied technologies journal for Superfund removals and remedial actions and RCRA corrective actions

Rummage Through the ATTIC

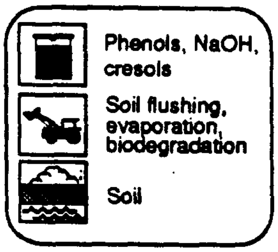
One-Stop Shopping

You can quickly enter EPA's Alternative Treatment Technology Information Center (ATTIC) Database when you need one-stop shopping to match up a cleanup problem at your site with the right innovative technology. EPA's ATTIC Database contains abstracts of alternative and innovative technologies for hazardous waste treatment from EPA, states, other federal agencies and industry. It's easy to use. Just search keywords such as "PCB" and "soil," and titles of documents about treating PCBs in soil appear on your computer screen. You can readily determine from abstracts whether or not the technologies have been pilot or field tested and if they're ready for you to use at a site. You get the name of a person to contact for further information.

With this issue of *Tech Trends*, we begin a series of articles that introduces you to ATTIC. October's article, "Out of the ATTIC" (starting on page 3), gives you an overall introduction to the five reference categories in ATTIC: thermal technology, biological treatment, solidification/stabilization processes, chemical treatment and physical treatment. Succeeding issues will highlight one reference category per issue in more detail, with examples of how your colleagues have used ATTIC.

Onsite Treatment of Phenols and Cresols in Soil

by Harry L. Allen, Environmental Response Team and Robert Mandel, OSC, Region IX

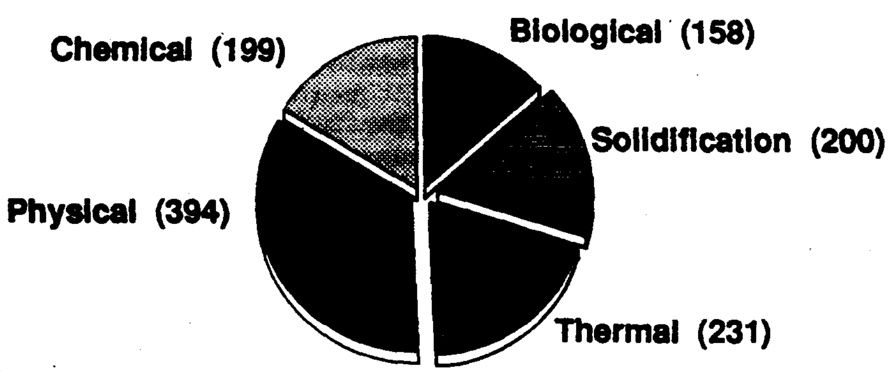


When Bob Mandel in EPA's Region 9 called the Environmental Response Team (ERT) in Edison, New Jersey, he got the answers he needed. Bob was seeking an onsite treatment technology to clean up the Poly-Carb Superfund site near Wells, Nevada. The arid, desert soil at the site was contaminated with phenol, sodium hydroxide and ortho-, meta-, and para-cresols that had spilled from above-ground storage tanks two years earlier. The Poly-Carb site is in the recharge zone for the ground-water aquifer that is the sole source of drinking water for Wells—and the site presented a major imminent threat to the aquifer. So, Bob wanted to quickly and effectively clean up the site, but without having to transport the hazardous wastes to Oregon.

To meet the challenge, ERT performed treatability studies using innovative techniques that had already been pilot tested in Edison. Based on the study results, ERT suggested a combination of soil flushing, passive evaporation and biological degradation to clean up the site. ERT had found soil flushing and passive evaporation to be clearly effective. Since the waste had been in the environment for two years prior to EPA's involvement, ERT assumed that acclimated microbes would have developed at the site for biodegradation.

*(see **Phenols** page 3)*

Treatment Technology Citations in ATTIC* Database

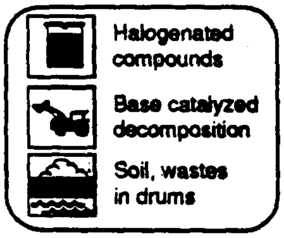


* *Alternative Treatment Technology Information Center*

SITE Subjects

Removing Halogenated Compounds with Base-Catalyzed Decomposition

by Charles Rogers
Risk Reduction Engineering Laboratory



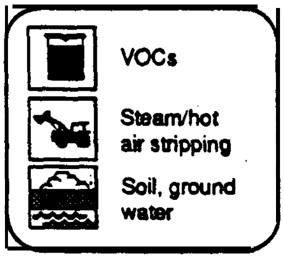
At the U.S. Naval Station site on Guam, EPA and the Navy will demonstrate a new way to chemically destroy halogenated organic compounds, such as PCBs, found in contaminated soil at the site. The cleanup technique, known as the base catalyzed decomposition (BCD) process overcomes a shortfall of incineration: the small quantities of furans and dioxins that remain. The BCD technique is an evolution of the Potassium Hydroxide Polyethylene Glycol (KPEG) process used at the Guam site and has been pilot tested in a small scale reactor at EPA's Risk Reduction Engineering Lab (RREL) in Cincinnati. Cost estimates indicate that it will cost about $245 per ton versus several times more per ton for landfill or incineration. The beauty of the process is that it can be used for all chlorinated or halogenated compounds in contaminated soil or in mixtures in drums. You also have the option of running the process continuously or in batches, depending on the size and conditions of your site.

Here's how the process works. The chemicals required for the BCD process are thoroughly mixed with the contaminated soil. The soil/chemical

(see BCD, page 4)

In Situ Steam/Hot Air Treats Soil from Below Water Table

by Mary Gaughan
Risk Reduction Engineering Laboratory



An innovative mobile *in situ* soil stripping technology was used at the Annex Terminal Site in San Pedro, California. The technology overcomes many of the traditional stumbling blocks to cleanup of volatile organic compounds (VOCs) in soil. Under EPA's SITE program, Toxic Treatments Inc. demonstrated their steam/hot air technology at the site. This technology can treat saturated or unsaturated soil down to a depth of 30 feet as well as ground water. Most existing technologies treat either the soil or the water, not both soil and water. Additionally, the way the treatment unit is constructed enables it to collect the contaminants as they volatilize from the soil, thus avoiding the problem of off-gassing of VOCs into the air that often occurs during cleanup of sites. The process eliminates the need for any excavation of the contaminated soil.

The *in situ* steam/hot air technology unit was the perfect match for the conditions at the Annex Terminal Site. The site stored VOCs such as hydrocarbons and solvents which had spilled from tanks into the soil. The steam/hot air equipment used in the cleanup sits on crawlers that move across the soil. The unit consists of three connected components: (1) a steam generator; (2) a box, called a shroud, with a drill; and (3) a gas processing unit. At the site, the drill moved down through the shroud into the soil column where it injected steam and hot air from the steam generator into the soil column. The steam and hot air caused the contaminants to volatilize and be forced up through the column into the shroud on top of the ground. The gas was then piped into a gas processing unit, condensed into liquid waste and collected in another unit for recycling, incineration, or disposal. The hot air and steam were recovered from the gas processing unit and recycled back into the steam generator to be used in the next soil column injection, as the unit moved on its crawlers across the site.

Based on the SITE demonstration test results, it is believed that greater than 90% of the VOCs can be removed. At this site, concentrations of VOCs were reduced, on average, from 466 ppm to 71 ppm with a removal of 85%. There was negligible migration of the organics. That is, the steam/hot air process was able to strip the contaminants from the soil with almost no forcing of the contaminants either laterally or downward into the surrounding soil or water. The technology has other advantages as well. Soil handling costs are eliminated because there is no need to excavate the soil. The technology is not limited, as many traditional technologies are, by soil conditions such as particle size, initial porosity, chemical concentration, or viscosity.

For more information, contact Paul dePercin at FTS-684-7797 or 513-569-7797.

Out of the ATTIC

by Myles E. Morse
Office of Environmental Engineering and Technology Demonstration

The Alternative Treatment Technology Information Center (ATTIC) Database is the database you want for the most up-to-date information available on alternative and innovative technologies for hazardous waste treatment. These technologies are grouped into five major categories: (1) Thermal Treatment; (2) Biological Treatment; (3) Solidification/Stabilization Processes; (4) Chemical Treatment; and (5) Physical Treatment.

The ATTIC Database contains abstracts and executive summaries from over 1200 technical documents and reports. Currently, 231 citations in the ATTIC Database (20% of the database) include thermal treatment technologies such as rotary kiln incineration, fluidized bed combustion, infrared incineration, pyrolysis and plasma heat systems. Some form of biological treatment or bioremediation technologies are found in 158 citations in the ATTIC Database (13% of the database). Biological processes include aerobic and anaerobic treatment, composting, biodegradation and microbial degradation of hazardous constituents.

The ATTIC Database contains 200 citations (17% of the database) for solidification/stabilization processes including aluminum silicate and cement-based fixation, pozzolanic-based fixation and vitrification. There are currently 199 citations for chemical treatment processes in the ATTIC Database (16% of the database). Typical chemical treatment processes include oxidation-reduction reactions such as ozonation, alkaline chlorination, electrolytic oxidation and chemical dechlorination. Physical treatment is highlighted in 394 citations in the ATTIC Database (34% of the database). Various physical processes include adsorption, distillation and filtration.

The ATTIC Database is the core of the Alternative Treatment Technology Information Center system. The system also includes other hazardous waste data from literature search databases, expert lists, treatability databases, transport and fate databases, cost models, case histories and expert systems. The ATTIC system is accessible to all members of the federal, state and private sectors involved in site remediation. ATTIC can be accessed through an online system, a system operator or through a disk-based version.

For help on how to use ATTIC, as well as information, call the ATTIC operator at 301-816-9153; Bill Sproat and his staff are ready to assist you. For general information on ATTIC, you can also call Myles E. Morse at FTS-475-7161 or 202-475-7161.

Phenols *(from page 1)*

The treatment system design required careful planning so that no one treatment technique would hamper another. The leach field was designed to contain the contaminated soil and leachate that would be generated by the soil flushing operation. A half-acre pit was excavated, graded and lined with a double liner of high density polyethylene with twelve inches of pea gravel between the liners as a leachate collection media, should the upper liner leak. Then, twelve inches of clean native soil were placed on the upper liner, followed with 30 inches of contaminated soil. For the leaching operation, sprinklers were placed in the center of the field to irrigate the contaminated soil. Water came from onsite wells, thereby eliminating the need for materials handling. The water dissolved the contaminants and flowed downhill to a pump that transferred the leachate to a holding tank, where it passed through granular activated carbon filters to remove the organics and through particulate filters to remove particulates. The filters were later incinerated. The treated leachate was then recycled to the soil with a sprinkler system. Passive evaporation and biodegradation then took over. Evaporation was enhanced because the layer of soil in the pit was relatively shallow, thus exposing the maximum soil surface area to the air. The dry and windy weather and high desert temperatures converted the soil-bound contaminants into air-bound vapor. There was no population downwind to be exposed to the evaporated contaminants.

Altogether, phenols and cresols were reduced by 99% after two months of flushing. Additional soil column studies indicated that biodegradation was leading to further reduction of contaminants. The cleanup results demonstrate that multiple complementary treatment options should be considered rather than one single approach. However, bench or pilot scale engineering and treatability studies are essential prior to choosing among treatment options. Further, simplicity in design and operation, such as the Poly-Carb site, can reduce project construction and labor costs. Cost analysis indicated that treatment costs will be $266/cubic yard—very competitive with the traditional approach of excavation, transportation and land disposal costing approximately $250/ cubic yard at a commercial offsite facility.

For more information, contact Harry Allen at FTS-340-6747 or 201-321-6747.

New for the Bookshelf

Recent EPA publications are available from ORD's Center for Environmental Research Information (CERI) in Cincinnati. You can order them electronically on the OSWER Electronic Bulletin Board or directly from CERI. To contact CERI's Publications Unit, call FTS 684-7562 or 513-569-7562. You must have the EPA report number or the exact title to order a document.

Second Forum on Innovative Hazardous Waste Treatment Technologies, Domestic and International. Contains abstracts of the proceedings and technical papers delivered at EPA's recent Forum on Innovative Hazardous Waste Treatment Technologies in Philadelphia, PA. **Document No. EPA/540/2-90/009**

Innovative Operational Treatment Technologies for Applications to Superfund Sites. Presents nine case studies, with operational data from ongoing and completed remediation efforts such as incineration of explosives in contaminated soils, ground-water extraction, etc. **Document No. EPA/540/2-90/006**

Emerging Technology Report: Removal and Recovery of Metal Ions from Groundwater. Discusses SITE program lab tests and onsite pilot scale demonstration of Biorecovery Systems' AlgaSorb Technology for removal and recovery of mercury-contaminated ground water. **Document Nos. EPA/540/5-90/005a and EPA/540/5-90/005b**

BCD

(from page 2)

mixture is then placed into a vessel called a reactor, which can be constructed at the site or brought in from another location. The reactor is heated, causing the BCD chemicals to react with the mixture to break down the pollutants by removing all the chlorine atoms from the compounds. The volatile contaminants removed from the soils are broken down further in another smaller batch scale reactor.

BCD typically uses only 100 lbs. of reagent per 2000 lbs. of soil and takes from 1/2 to 4 hours (with a norm of one hour) to clean up the contaminated soil. BCD removes all the chlorine atoms from the pollutant mixture. The design of the BCD reactor permits the option of continuous feeding and removal of the soil. These BCD test results are based on pilot tests in a small scale reactor at RREL, using soil from the Guam site. The soil contamination levels at the Guam site range from 600 to 43,000 ppm of PCBs. BCD treatment reduced the levels to less than 2 ppm.

For more information, contact Charles Rogers at FTS-684-7757 or 513-569-7757.

Tech Trends welcomes readers' comments, suggestions for future articles and contributions. Address correspondence to: Managing Editor, Tech Trends (OS-110), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, DC 20460.

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